Book Review

Oliver Heaviside: Sage in Solitude. *Paul J. Nahin. IEEE Press NY, 1988. 344 pp., photographs, $57.95; IEEE member $43.45.*

The life, work and times of an electrical genius of the Victorian Age, by Professor Paul J. Nahin, University of New Hampshire, and sponsored by the IEEE History Committee, are now available in a book for IEEE Members and others. It was a labor of love. The author should be congratulated for producing such a splendid work. To quote from his Preface, "It has been the most enjoyable and satisfying intellectual accomplishment of my life." So let the readers rejoice and enjoy reading this book.

Oliver Heaviside (1850–1925) had a long, solitary life. He worked mostly by himself under difficult conditions. His contribution to inductive loading (loading coils) made long distance communication possible. The Heaviside layer (it was alternatively called the "Kennelly–Heaviside layer") was well known to the early wireless people.

Perhaps Heaviside's most important contribution to science is his contribution to Maxwell's electromagnetic equations. In his Electrical Papers, Heaviside wrote: "It will be understood that I preach the gospel according to my interpretation of Maxwell."

On page 9, Note 3, the author wrote: "It suffices here to say that nowhere in Maxwell's writings do the equations for the electromagnetic field appear as we write them today. Maxwell used an amalgamation of Cartesian component and quaternion notation, and it was Heaviside who first wrote the electromagnetic field equations in modern vector form."

According to Sir Edmund Whittaker, "The great service which Heaviside rendered to science was . . . to base the theory on what he called the 'duplex' equations . . . which modern writers generally call 'Maxwell's equations'—though they are not found in Maxwell's *Treatise*, and the modern writers have in fact copied them from Heaviside." (See page 112.)

Hertz acknowledged Heaviside's priority as follows; "Mr. Oliver Heaviside has been working in the same direction ever since 1885. From Maxwell's equations he removes the same symbols [the potentials] as myself; and the simplest form which these equations thereby attain is essentially the same as that which I arrive. In this respect, then, Mr. Heaviside has the priority." (See page 111.)

Professor August Föppl of the Technical University in Munich wrote in 1894: "I consider Heaviside to be the most eminent successor to Maxwell in regard to theoretical developments."

Heaviside returned his compliment as follows: "Dr. Föppl thoroughly appreciates that the best way [i.e., Heaviside's way!] of exhibiting electric and magnetic relations is not by potentials, but by the electric and magnetic fluxes." (See page 113.)

Are Maxwell's equations good for Theory of Relativity? The question was raised by Heaviside when Professor E. J. Berg of Union College visited him in 1924. Professor Berg assured him that the Maxwell equations are O.K., and Heaviside was delighted. (According to the reviewer's recollection in hearing the story from Prof. Berg.)

Heaviside's "Operational Calculus" was the subject of four textbooks from 1926 to 1929 by J. R. Carson, L. Cohen, Vannevar Bush and E. J. Berg. The reviewer attended Professor Bush's pioneer class with M. F. Gardner and others at MIT. The reviewer then successfully applied Heaviside's "shifting theorem" to change the electric quantities in a rotating machine from the stationary reference frame to a rotating reference frame. The new quantities are known as the

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forward and *backward* components (or *KU* variables according to Professors White and Woodson's book "Electromechanical Energy Conversion" (Wiley, 1959).

In the years 1926–28, the reviewer was introduced to Dr and Mrs B. A. Behrend, good friends of Heaviside. The Behrends bought Heaviside's books after the hermit's death and donated them to the Library of IEE, London. The reviewer saw the collection at the IEE Library in London in early 1929. In February 1928, Dr Behrend gave the reviewer Heaviside's "Electromagnetic Theory" in three volumes. In writing this note, the reviewer wishes to pay his tribute to Oliver Heaviside and express his grateful memory to Dr and Mrs Behrend.

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